PCT/AU2004/001580

Patent Office
Canberra

I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003906324 for a patent by TELEZYGOLOGY INC as filed on 17 November 2003.

WITNESS my hand this
First day of December 2004

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT
AND SALES

AUSTRALIA
Patents Act 1990
PROVISIONAL SPECIFICATION

Name of Applicant: **TELEZYGOLOGY INC**
Actual Inventor:
Address for Service:

Chrysiliou Law
Patent and Trade Mark Attorneys
15-19 Parraween Street
Cremorne NSW 2090

Invention Title: **Improved Framing System**

The following statement is a description of this invention

\\server\e\docs\hr\0311x112.doc

This invention is concerned with an improved framing systems.

The invention has wide application, as will be apparent from the description below.

For convenience, the word "frame" and its derivatives are used in this specification. It is to be understood that, unless the context otherwise requires, the term "frame" and its derivatives are to be interpreted in the sense of "platform" or "base" and not restricted to an open structure.

In a first broad aspect, the invention provides an improved framing system wherein the frame includes one or more attachment nodes. Preferably, the framing system is adapted to enable delivery of one or more of energy, data and material.

The frame itself may be provided in components. Parts or accessories (e.g., a fairing) may be added to the frame and, being provided with one or more attachment nodes, may form an extension of the frame.

The frame can be chosen from a wide range of materials and configurations, suitable for use in many industries. By way of non-limiting example, the frame may take the form of a skeleton, carcase or chassis for a motor vehicle, a skeleton for furniture, a support for use in the building industry or a plumbing system. Many other applications may be apparent to one skilled in the art after consideration of some of the detailed description below.

The frame or some of it may act as a conduit for energy, data and/or material in any suitable way. Some non-limiting examples follow.

The frame may be used to deliver energy in the form of electrical energy by use of conventional wiring or buses. The frame may enable delivery of other types of energy, such as pneumatic or hydraulic energy, by suitable means.

In relation to the delivery of data, this may involve various data transfer means, for example, transfer of data in a networking environment in known manner. A single medium, such as a cable, for example, on or within the frame, may be adapted to deliver both energy and data.

The material for which the frame may provide a conduit may be any suitable material, including gas, liquid and mixtures of these.

Preferably, the improved framing system of the invention includes a plurality of attachment nodes. It is further preferred that each of the attachment nodes enables attachment and/or detachment of modules or accessories to the frame. Any suitable fastener may be used in conjunction with such an attachment node. Some suitable fasteners are described below, but the invention is not limited to these.

The improved framing system for the invention preferably delivers energy, data and/or material to an attachment node to assist in attachment and/or detachment of modules or accessories. An example will now be given in connection with a motor cycle. Once again, this is not limiting on the scope of the invention.

In this embodiment, the frame resembles a conventional motor cycle frame which may have energy and data conveyed by cables within some or all of the frame. The frame has a number of attachment nodes connected to the energy/data cable system. The frame acts as an attachment point for all desired components, such as the motor, instruments, windshield, seats, fuel tank, storage systems, vehicle lights, instrument lights, fairings and cowlings. The attachment nodes for these components may include fasteners which are concealed when the components are in place and which are actuated in one of several ways. As one method of actuation, signals may be transmitted via cabling from a central control on the motor cycle or external to it, perhaps using a computer or custom built device. As another example, signals may be transmitted remotely by any suitable means, including infra-red or radio wave communication, perhaps through a button on a key chain fob, or from a conventional ignition switch.

This embodiment may enable a motor cycle to be assembled in a completely different way than at present. Fasteners may be concealed. Assembly of the motor cycle may not require conventional tools or robots. This can greatly simplify design and enhance aesthetics.

During assembly, fasteners at the attachment nodes may be programmed to allow parts or components to be attached automatically as a production line is moving. This can redefine assembly sequencing processes during manufacture. Instead of traditional physical or mechanical contact, fasteners can lock, unlock and connect mechanically, in response to commands transmitted electronically, remotely or by hard wiring or any other suitable means. It is envisaged that many or even all components may be assembled to the frame of a motor cycle in this way, including, for example, suspension or shock absorbers. There are many other advantages, such as the ready

ability to change options during manufacture by interchanging one component for another without having to disrupt the production line.

The motor cycle of this embodiment can enhance servicing. For example, fasteners and attachment nodes may include microchips which have secure addresses that respond to only to encrypted signals. This makes the fasteners accessible only to designated dealers and technicians. In addition, fasteners may be programmed to detect, analyse and report problems that require service. Service procedures may be stored in fastener control software. This can assure installation of authorised replacement parts while providing precise service histories and documentation for warranty claims. For example, microprocessors may capture information about fastener status (locked, unlocked, damaged, stressed, present or not) and maintenance history, including dates, times, places and identity of the technician performing each process.

Insofar as the "after market" is concerned, the motor cycle of this embodiment can be quickly and simply customised to any situation or aesthetic taste. Parts and accessories can be interchanged to suit the need or occasion. Using a single, standard frame, a motor cycle may be restyled with selected fairings, fuel tanks, gauges, lights and many other components.

It is possible to retrofit such a motor cycle with optional accessories, such as saddlebags, windshields, GPS systems and entertainment systems.

Security in such a motor cycle is enhanced. Thieves may have no access to hidden fasteners without destroying the component they intend to steal.

From the point of view of the authorised user of the motor cycle, there can be provided single point locking for removable components, such as fuel tank, steering, panniers, fairings and helmet, overcoming the need for a multiple array of keys, one for locking each component.

The same motor cycle frame can be used for a sports model or a touring bike, or any other customisation. For example, a single seat and body fairings may be removed and replaced with a touring tank, twin seats and touring panniers. By way of another example, a street-legal motor cycle can be transformed to an off-road dirt bike by releasing lights, indicators, plates and other accessories.

The fasteners suitable for use with the improved framing system of the invention are preferably a type of "intelligent fastener" which has a fastening mechanism, an

actuator and a micro processor. Many types of fasteners may be suitable. Some specific fasteners are disclosed below and form different aspects of this invention. The type of fastener to be used with the improved framing system of the invention is not limited to the fasteners disclosed below. Other fasteners may well be useful, including those disclosed in the following patent specifications, the contents of which are incorporated herein by reference: International Patent Application No. PCT/AU99/00185, International Patent Application No. PCT/AU03/00759, Australian Patent Application No. 2002953616 and Australian Patent Application No. 2003905644.

Generally, the fastener suitable for use in the system of the invention will perform to the same specifications as mechanical fasteners, having transfer forces which meet traditional requirements for tension, shear and clamp. Preferably, the fasteners will also have the capability to report their own status, report on what parts are in place and report on whether the fasteners are attached or unattached, attached properly or overstressed.

Some fasteners will now be described as further aspects of this invention. While the fasteners may have been designed for use with the first aspect of the invention, it is to be appreciated that the fasteners in the further aspects of the invention are not limited to this use and may have wider application.

In a second aspect, this invention provides a fastener which represents a variation of a fastener disclosed in International Patent Application No. PCT/AU03/00759 ("the original beam fastener"). The original beam fastener had a flexible beam which was movable between an engagement position and a disengagement position when actuating means were activated. The actuating means included a material adapted to contract when activated, such as a shape memory alloy. In the fastener of the second aspect of this invention, it is no longer necessary that the beam is flexible. Accordingly, this invention provides in the second aspect a fastener which includes:

(a) a fastening element having a beam, an engagement means and a pivot point separate from the beam; and

(b) actuating means attached to the fastening element and including a material adapted to contract when activated;

wherein the beam is movable, upon contraction of the material, between an engagement position and a disengagement position.

The fastener of this second aspect of the invention is designed so that, when the material contracts, the fastening element pivots or moves about the pivot point and the engagement means is drawn out of the engagement position. The fastener may be otherwise as disclosed in International Patent Application No. PCT/AU03/00759, except that it is not necessary that the beam flexes to enable the engagement means to disengage.

The pivot point is preferably located forward of the engagement means so as to improve force geometry and to increase the retaining strength of the fastener. An example of this is illustrated in the attached drawings.

It is preferred that the material which contracts when activated is contained in one or more grooves in the beam. This can provide physical protection for the material as well as decreasing heat up/cool down times. It can also reduce ambient temperature effects and increase beam strength.

It is further preferred that bias means, urging the fastener to the engagement position, are provided. A non-limiting example of such bias means is a leaf spring preferably of metal. This can urge the material to stretch out once it has cooled and relaxed. It can also greatly reduce any potential for creep deformation in the fastening element when made of plastic.

Because the beam does not need to bend, it may be made thicker and can have more strength.

In a third aspect, the invention provides a fastener which was developed to suit multiple attachment points in retaining panels, such as in automotive use or for furniture. The fastener is not necessarily restricted to these applications. At least in some respects, the invention in this third aspect may be regarded as a variation of the invention in the first aspect disclosed in Australian patent specification No. 2003905644. In that specification, the invention in the first aspect provided a releaseable fastening system including a pin adapted to be received in an aperture, the system including means associated with the aperture for locking or unlocking the pin, the means including a material adapted to contract when activated to unlock the pin.

As was explained in application No. 2003905644, the pin may be chosen from a large range of suitable shapes. As one example, the pin may be generally circular in cross-section, tapering in towards the base. The pin may include a groove around its circumference. The groove may be adapted to receive a locking means around some or all of the circumference of the groove.

The variation in the third aspect of the present invention provides a preferred embodiment of the same releaseable fastening system, in which the pin includes a groove around all or part of its circumference. The groove is adapted to receive a locking means in the form of a collar, at least part of which can enter the groove. A material adapted to contract when activated is attached to the collar to move it out of engagement with the groove when activated and so permit release of the pin.

The pin may be a peg, bolt or any other suitable element.

The material which contracts when activated may be the same as that previously described above, for example.

The collar in this embodiment may be a type of circlip. Preferably, the pin is designed with a taper so that it can be pushed into the aperture and through the collar without the need for any activation of the collar. The taper on the pin can serve to form a ramp pushing the collar apart until it snaps into the groove. In this configuration, the fastener is engaged. To disengage the fastener, it is necessary to activate the material so that it contracts and pulls the collar out of engagement with the groove. Detailed explanation of the type of material, such as shape memory alloy, which will carry out this function, has been disclosed in the prior applications imported herein by reference.

This fastener is capable of being produced at a low cost, with minimum parts and in a very small size. It is suited to high volume mass production and may be designed so as to require only low power consumption, if thin conductors are used.

This type of fastener may be particularly suitable for fixing door trims, for example, in automobiles, especially in connection with the system of the invention.

Turning now to the fourth aspect of the invention, the fastener for this aspect has been developed especially for rugged high-wear applications, such as securing equipment to a vehicle. This fastener is capable of being strong and carrying a high load. It is to be understood that the fastener in the fourth aspect is not limited to these parameters, however.

The invention in the fourth aspect provides a releaseable fastening system including a pin adapted to be received in a cavity, the pin having first engagement means, second engagement means associated with the cavity for engaging the first engagement means and locking means for maintaining the second engagement means in engagement with

the first engagement means, the locking means adapted to release the second engagement means by means adapted to contract when activated.

The pin may be a peg, bolt or any other suitable element.

The first engagement means is preferably a groove or indentation around all or part of the circumference of the pin.

The second engagement means preferably has one or more elements designed to fit into the groove or indentation/s in the pin. Preferably there are several such second engagement means.

The locking means is preferably a moveable stop which prevents the second engagement means from moving out of contact with the first engagement means, once engaged, until the stop is withdrawn from that position by material which contracts when activated. As before, this material is preferably shape memory alloy or similar material.

The locking means is preferably biased towards the locked position by a regular spring.

It is particularly preferred that a retractable cap is included in the releaseable fastening system of the fourth aspect of the invention, to present a smooth appearance when the pin is not inserted in the cavity. An example of this is described in connection with the drawings, below. If the retractable cap is included, it can be pushed further into the cavity by the pin when the pin is inserted in the cavity, the retractable cap being spring biased towards the cavity opening. This embodiment can have a clean flat visual finish when not in use.

It is also preferred that the retractable cap, when used, also has first engagement means, similar to the pin. In this way, the retractable cap can work the same way as the pin in the releaseable fastening system of this fourth aspect of the invention in so far as the cap is locked or released by the locking means. If this embodiment is utilised, it may be necessary to include means enabling the cap to be withdrawn from the cavity and/or to provide some indication that the cap has been released.

As a variation of the fastening system of the fourth aspect, the pin and a core in the cavity may contain conductors for power and data connections for the releaseable fastening system or conduits for other material, e.g., liquid, gas. This may accommodate, for example, a GPS system connected to the power source of, for example, a motor cycle.

As set out above, the fastening system of the fourth aspect of the invention can be constructed so as to be rugged for high load and high usage applications. It can be dust and water resistant if it includes the retractable cap or a sprung cover. It can be designed so that the pin can be inserted in the cavity and engaged without any need for activation of the contractible material. However, it is intended that the contractible material must be activated before disengagement can take place.

It will also be appreciated that the invention in the fourth aspect may not provide for "insertion anytime" as is the case with at least some of the previous aspects. It is preferred that the fastening system of the fourth aspect of the invention requires positive disengagement of the locking means before the pin may be inserted in the cavity.

In a fifth aspect, this invention provides a fastening system including;

first engagement means;

second engagement means; and

a locking element moveable between a locked position in which the first engagement means is maintained in engagement with the second engagement means and an unlocked position in which the first engagement means is free to disengage from the second engagement means;

wherein the locking element is adapted to be moved to the unlocked position by means adapted to contract when activated.

The first engagement means preferably includes projections mounted on a pair of arms, the projections being designed to be received within a complementary cavity comprising the second engagement means. In this embodiment, the locking element is preferably located between the arms of the first engagement means. In the locked position, the locking element holds the projections of the first engagement means in the cavity of the second engagement means. The locking element is preferably designed to be pulled away from its position between the projections to enable the projections to move inwardly towards one another and be withdrawn from the cavity of the second engagement means. Is some respects, this can be regarded as similar to the construction of the locking element exemplified in International Patent Application No. PCT/AU99/00185.

It is further preferred that the locking element is in the form of a strip and that likewise the first engagement means and the second engagement means are provided

in strip form. Examples of these were also given in International Patent Application No. PCT/AU99/00185.

The means adapted to contract when activated preferably comprise or include shape memory alloy wire, such as that disclosed in connection with International Patent Application No. PCT/AU03/00759. Other materials may also be suitable.

The fastening system is preferably designed so as to be maintained in the locked state in the absence of any power. For release, when the means adapted to contract when activated are shape memory alloy wire, switching on the power enables the SMA wire to heat and contract, pulling the locking element out of the locked position. If the SMA alloy wire is permitted to cool, the fastening system can be biased so that it will return to the locked position.

Preferably, the fastening system in this embodiment includes a printed circuit board or other means for controlling the amount of power to the SMA wire. The same means can enable reporting in relation to the fastening system, such as status, the number of times the fastening system has been released and if there has been any damage.

In a sixth aspect, this invention provides a fastener which includes:

(a) a fastening element;

(b) actuating means attached to the fastening element and including a material adapted to contract when activated; and

(c) restoring means adapted to restore the material to a relaxed state when no longer contracted.

The sixth aspect of the invention may be used in conjunction, with, for example, the fastener in the second aspect of this invention, or the fastener disclosed in International Patent Application No. PCT/AU03/00759, or in conjunction with other fasteners, disclosed in this specification or otherwise.

The fastening element may be any suitable fastening element.

The material adapted to contract when activated is preferably shape memory alloy wire, as has been disclosed or discussed before.

The restoring means is preferably an elastomeric material which is adapted to be deformed by contraction of the material such as the shape memory alloy wire and which is also adapted to return to its original shape after the material (such as the

SMA wire) relaxes. Preferably, the restoring means contains, surrounds or encases the SMA wire. Suitable material for the restoring means will be apparent to one skilled in the art. One suitable material may be polybutyl sulphide. For example the SMA wire may be contained within a hollow body of the restoring means. As another example, the SMA wire may be embedded within a solid body of the restoring means. As yet a further example, the SMA wire may be attached to a strip of the restoring means.

The restoring means may impart a linear force on the SMA wire (or other material) in order to restore it to the original configuration when relaxed. However, the invention is not limited to this. The forces may be in any suitable direction or combination of directions. Some of these are illustrated in the drawings, below. The aim of the restoring means is to restore the shape memory alloy wire or other suitable material to the position it had before contraction.

By using an elastomeric material, it is possible to dispense with return springs. The restoring means can also act as a heat sink for SMA wire. The restoring means can also enhance the ruggedness of the fastener, protecting the shape memory alloy wire from damage during handling, transport, etc.

The invention will now be described in connection with certain non-limiting examples thereof in the accompanying drawings, in which:

Figure 1 is a sketch of a motor cycle incorporating the first aspect of the invention and showing diagramatically the location of some of the attachment nodes;

Figure 2 shows the rear part of the motor cycle of Figure 1, in connection with the attachment of a pannier;

Figure 3 is a similar view to that in Figure 2, with the pannier in place;

Figure 4 is a similar view to that in Figures 2 and 3, illustrating attachment of alternate forms of a seat;

Figure 5 shows a front portion of the motor cycle of Figure 1, illustrating detachment or attachment of a windshield,

Figure 6 shows the front part of the motor cycle of Figure 1, showing nodes for attachment of a GPS system and a fuel cap;

Figure 7 is a side elevation of the fastener of the second aspect of the invention in the engaged position;

Figure 8 is the fastener in Figure 7 in the disengaged position;

Figure 9 is the fastener of Figures 7 and 8 in rear elevation;

Figure 10 is a side elevation of part of the fastener of the third aspect;

Figure 11 is the fastener of Figure 10 in plan view, in the engaged state;

Figure 12 is the fastener of Figures 10 and 11 in the disengaged state;

Figure 13 is an embodiment of the fastening system of the fourth aspect, before entry of the pin into the cavity;

Figure 14 shows the fastening system of Figure 13 in the locked position;

Figure 15 shows the fastening system of Figures 13 and 14 in the unlocked positions;

Figure 16 shows an embodiment of the fastener of Figures 7, 8 and 9 in a practical application;

Figure 17 shows in cross sectional view an embodiment of the fastening system of the fifth aspect, in the locked position;

Figure 18 is a side elevation (cross section) of the embodiment of Figure 17, still in the locked state;

Figure 19 is a cross sectional view corresponding that to Figure 17 but showing the fastening system in the unlocked state;

Figure 20 corresponds to Figure 18, but showing the fastening system in the unlocked state;

Figure 21 shows in sectional illustration a second embodiment of the fifth aspect of the invention;

Figure 22 shows in a cross sectional side elevation a further application of an embodiment of the fastener of the second aspect of the invention;

Figure 23 is an exploded view of an embodiment of a disc case, using a remotely activatable fastener system;

Figures 24 and 25 illustrate a first embodiment of the sixth aspect of the invention;

Figures 26 and 27 illustrate a second embodiment of the sixth aspect;

Figures 28 and 28 illustrate a third embodiment of the sixth aspect; and

Figures 30-32 illustrate a fourth embodiment of the sixth aspect.

Turning first to Figure 1, framing system 10 (only part of which can be seen in this figure) has several attachment nodes 12 which are hidden from view in most cases by the fairings and cowlings attached to frame 10. The fastener at attachment node 12a is preferably of the type illustrated in Figures 7 to 9 and the fastener at attachment node 12b is preferably of the type illustrated in Figures 10 to 12

Individual attachments are shown in Figures 2 and 3, where pannier 14 is to be attached to framing system 10. Pannier 14 has two fasteners 16 for insertion in attachment nodes 12. Fasteners 16 preferably are the type illustrated in Figures 13 to 15, described below. Figure 7 shows pannier 14 mounted securely in place. As can be seen in Figure 3, fasteners 16 are hidden when pannier 14 is mounted. Pannier 14 cannot be removed without authority, without damage to pannier 14 and this can enhance security.

Turning now to Figure 4, frame 10 has attachment nodes 12 for two alternate versions of seat 18a and 18b. Seat 18a is a single seat whilst 18b is a double seat with a luggage carrier 20. This Figure illustrates the versatility of the framing system of the invention when applied to a motor cycle. When touring, seat 18a can be removed and replaced by seat 18b, for example.

Figure 6 shows in diagrammatic form the attachment of windscreen 22 to framing system 10 by suitable fasteners (not shown). Windscreen 22 can be removed when not required.

In Figure 6, GPS system 24 is shown as attachable to handlebars 23. In the same Figure, fuel filler cap 28 can be included in the framing system of the invention. This can help to prevent theft of fuel since fuel filler cap 28 cannot be removed without authorisation or without considerable damage.

Turning now to the beam fastener being an embodiment of the second aspect of the invention and illustrated in Figures 7 to 9, fastener 30 includes fastening element 32 having a beam 34, an engagement means 36 and a pivot point 38. As can be seen, pivot point 38 is separate from beam 34.

As shown in the rear elevation in Figure 9, shape memory alloy wire 40 forms a loop in a groove 44 in the back of beam 34 and is attached at each end to electronic module 42. Wire 40 is shown partly in dotted outline in Figures 7 and 8.

When wire 40 is heated by a current generated through electronic module 42 and wire 40 reaches a pre-determined temperature, it shrinks as shown in Figure 8. Fastening element 32 bends or pivots at pivot point 38 and engagement means 36 is drawn out of engagement with an engaging surface (not shown). As shown in Figure 8, leaf spring 46 is compressed. If wire 40 is allowed to cool, it relaxes and leaf spring 46 decompresses, urging engagement means 36 back into engagement with the engaging surface (not shown).

This embodiment can provide an enhanced positive engagement through engagement means 36 and greater strength to fastener 30, since beam 34 is not required to bend.

Reference is now made to the embodiment of the invention in the third aspect in Figures 10 to 12. In this embodiment, fastening system 50 includes pin 48 adapted to be received in aperture 52. Means 54 in the form of a circlip are adapted to lock into groove 56 in pin 48.

Aperture 52 is formed in plastic fastener body 58 which includes ridge 60. Travelling around ridge 60 is shape memory alloy wire 40. Insulated plastic caps 62 connect crimped ends (not shown) of wire 40 to circlip 54 and power leads 64.

Figure 11 shows fastening system 50 in the locked state. In this stage, pin 48 may be pushed into aperture 52. Taper 66 on pin 48 serves to push circlip 54 apart, until it rides into groove 56, where it remains locked. Thus, there is no need to activate wire 40 in order to insert pin 48 in aperture 52.

Figure 12 shows fastening system 50 in the unlocked position. In this Figure, wire 40 has been heated through power fed from leads 64 to wire 40, to the extent that wire 40 contracts. Through its connection at caps 62 with circlip 54, wire 40 in the contracted state and restrained by ridge 60 draws circlip 54 apart, freeing circlip 54 from groove 56 and permitting the unfastening of pin 48.

Referring now to Figures 13 to 15, these show an embodiment of the fourth aspect of the invention. In this embodiment, releaseable fastening system 70 includes pin 68 adapted to be received in cavity 72. Pin 68 has first engagement means in the form of indentation or groove 74 around the circumference of pin 68. Associated with cavity 72 in fastener body 76 are second engagement means in the form of arms 78 having protrusions 80 designed to fit within indentation 74 in pin 68.

Once pin 68 is pushed into cavity 72, protrusions 80 on arms 78 snap into indentation 74. Stop 82 prevents disengagement by blocking outward movement of protrusions

80 on arms 78. Activation of shape memory alloy wire 40 contracts wire 40 and draws stop 82 from its blocking position against arms 78. Arms 78 may be biased to spring outwardly as shown in Figure 15, facilitating withdrawal of pin 68 from cavity 72. Spring 84 is biased to urge stop 82 to the locked position shown in Figures 13 and 14.

In the illustrations in Figures 13 to 15, both pin 68 and fastener body 76 include conductor pins 86. These are optional. They may be used to provide power and data connections for the fastening system 70.

Another optional feature is shown in Figures 13 to 15, in the form of retractable cap 88. This is used to provide a flat visual appearance on outer surface 90 of frame 10. In the embodiment shown, it is necessary to activate wire 40 in order to draw stop 82 from its blocking position against arms 78. Once that has occurred, pin 68 can push cap 88 against the bias provided by spring 92, from the position shown in Figure 13 to that in Figure 14. In this position, shape memory alloy wire has relaxed to lock pin 68 into position. Figure 15 shows the unlocked position before withdrawal of pin 68 form cavity 72.

Figure 16 shows a practical application for fastener 30 illustrated in Figures 7-9. In Figure 16, fastener 30 is shown in situ fastening cap 31 to base 33. As can be seen in Figure 16, engagement means 36 of fastener 30 engage ledge 35 of cap 31. Three batteries 37 provide a power source for electronic module 42, being activated by switch 39.

When switch 39 is pressed, batteries 37 provide power to electronic module 42, which heats shape memory alloy wire 40 sufficiently to cause shape memory alloy wire 40 to contract. Engagement means 36 is drawn out of contact with ledge 35. Cavity 41 is provided in cap 31 to allow for this movement of beam 34. When switch 39 is pressed, LED 43 lights up to show that switch 39 has been activated.

Dowels 45 are provided in channels in cap 31 and base 33. These assist in location when cap 31 is being placed on base 33. During release, dowels 45 in conjunction with leaf spring 47 urge cap 31 to separate from base 33.

Charging contacts 49 can be used to recharge batteries 37 if of the rechargeable type.

Referring to the embodiment of the fifth aspect of the invention, in Figures 17-20, fastening system 100 has first engagement means, being arms 94 and protrusions 96,

and second engagement means, being complementary cavity 94 in cap 102. Fastening system 100 is intended to hold cap 102 onto base 104.

Locking element 106 is in strip form and is slidable vertically between arms 94, as can be seen from comparing Figures 17 and 18 to Figures 19 and 20. Lugs 107 which assist location of locking element 106 between arms 94 are located in slots 109 in locking element 106.

Locking element 106 is attached to shape memory alloy wire 40. The tension in wire 40 can be adjusted by tension screw 110.

Spring 112 assists in maintaining fastening system 100 in the locked state when no power is applied and also assists in returning spring 40 to its original, elongated status when it cools after contraction.

Batteries 37 are activated by switch 39 to provide power to fastening system 100. Printed circuit board 108 programs the amount of power fed to wire 40. For example, printed circuit board 108 can permit power to be fed to wire 40 in a series of steps until the desired temperature has been reached, at which stage printed circuit board 108 can switch off the power to allow wire 40 to relax. Printed circuit board 108 can also provide reports on the status, history, etc of fastening system 100.

The embodiment of the fifth aspect of the invention in Figure 21 does not show a strip form of locking element as in the previous embodiment. However, generally, the same numerals will be used for convenience. In the Figure 21 embodiment, fastening system 100 has first engagement means including arms 94 and protrusions 96. Second engagement means is comprised by cavity 98 in cap 102. As shown, cap 102 is locked to base 104 when protrusions 96 are engaged in cavity 98 by brass slug 114, which in this embodiment is the locking element. Brass slug 114 is attached to smart memory alloy wire 40 as shown. Spring 112 urges brass slug 114 to its locking position between protrusions 96. When switch 39 is activated, printed circuit board 118 ensures that batteries 37 provide the appropriate power to wire 40 to heat wire 40 to the temperature at which it contracts, drawing slug 114 out of position between protrusions 96. At this stage, protrusions 96, which are biased inwardly on arms 94, can clear cavities 98 and allow cap 102 to be released from base 104.

Charging contact 49 is provided for recharging batteries 37. Charging contact 49 may take the form of a socket or plug to be mated with a corresponding plug or socket (not shown).

Figure 22 shows a container for one or more discs 118, such as compact discs or video discs (eg, of the DVD type). Cover 22 is held in the locked position by two (or more) fasteners 30. Each fastener 30 is the same as or similar to the fastener 30 shown in Figures 7-9. Engagement means 36 engage ledge 35 of cover 116.

Power to fasteners 30 is supplied by batteries 37. When shape memory alloy wire (not shown in this drawing) to fasteners 30 is heated so that it contracts, engagement means 36 is drawn out of contact with ledge 35. Ejector 120, under the influence of spring 122, ejects cover 116. Cover 116 may include finger grooves (not shown) to assist in manipulation of cover 116.

In Figure 22, discs 118 are enclosed between cover 116 and base 124, which forms part of a substructure or chassis. As an alternative, cover 116 and base 124 may be replaced by a separate container having a cover and base, both of which can be removed together. Such a container can then be transported separately with the discs inside. The container may resemble that in Figure 23, below, for example, with the addition of a ledge or other suitable surface for engagement by fasteners 30.

In Figure 23, case 130 has base 126 and lid 128. Container 130 may contain one or more discs 118. Discs 118 are held onto base 126 by sleeve132 which fits over spindle 134. Sleeve 132 includes square cavity 136. This is shaped to receive square magnet 138.

Case 130 cannot be opened unless square magnet 138 is fitted into cavity 136. During normal conditions, for example when case 130 is being transported, or when it is desired to keep case 130 closed, removable cap 140 is kept in position at the top of case 130, optionally positioned to fit over lugs 142. Cap 140 is made of or contains ferrous material and draws magnet 138 upwardly when on top of lid 128.

When it is desired to open case 130, cap 140 is moved from the top of lid 128 to a corresponding position underneath base 126. In this position, magnet 138 is drawn into square cavity 136 and lid 128 can be removed from base 126.

Cap 140 is readily available to open case 130, since it is usually located on lid 128.

In Figure 24, shape memory alloy wire 40 is shown encased in elastomeric material 144. In Figure 24, SMA wire 40 is in the relaxed, uncontracted state. In Figure 25, wire 40 has contracted, causing elastomeric material 144 to be compressed vertically. Elastomeric material 144 retains the tendency to return to the original configuration in Figure 24. Consequently, as soon as wire 40 has been allowed to cool to the required

temperature, it relaxes and returns to the configuration in Figure 24 under the influence of elastomeric material 144.

In the Figure 26 and Figure 27 embodiment, there are three SMA wires, 40a, 40b and 40c. When wires 40a and 40b are heated to contract, elastomeric material 144 bends to the left side as shown in Figure 27. When wires 40a and 40b relax, elastomeric material 144, with its tendency to restore itself to the original shape, will stretch out wires 40a and 40b to the configuration shown in Figure 26.

It will be appreciated that wire 40c, if activated, will bend elastomeric material 144 to the right.

In Figures 28 and 29, SMA wire 40 is wrapped around elastomeric material 144 to form a spiral. When wire 40 is activated to contract, it compresses elastomeric material 144 which thus elongates as shown in Figure 29. The tendency of elastomeric material 144 to return to its original shape will urge wire 40 to extend, when it has cooled sufficiently, to return the assembly to the Figure 28 configuration.

In Figures 30, 31 and 32, the SMA wires are shown as forming the sides of a series of triangles. Together, these are situated on the surface of a three dimensional body of elastomeric material 144. Contraction of alternate wires 40 causes elastomeric material 144 to twist as shown by arrow 146 in Figure 32. Once again, the restoring force of elastomeric material 144 can return the body to the original configuration.

Contraction of all wires 40 together will cause the three dimensional body to elongate, as in the Figure 28 and 29 embodiment.

It will be appreciated that the embodiments described herein are illustrative only and that other expressions of the invention in its various aspects may be made without departing from the spirit and scope of the invention.

Dated this 17th day of November 2003

TELEZYGOLOGY INC

By its Patent Attorneys

CHRYSILIOU LAW

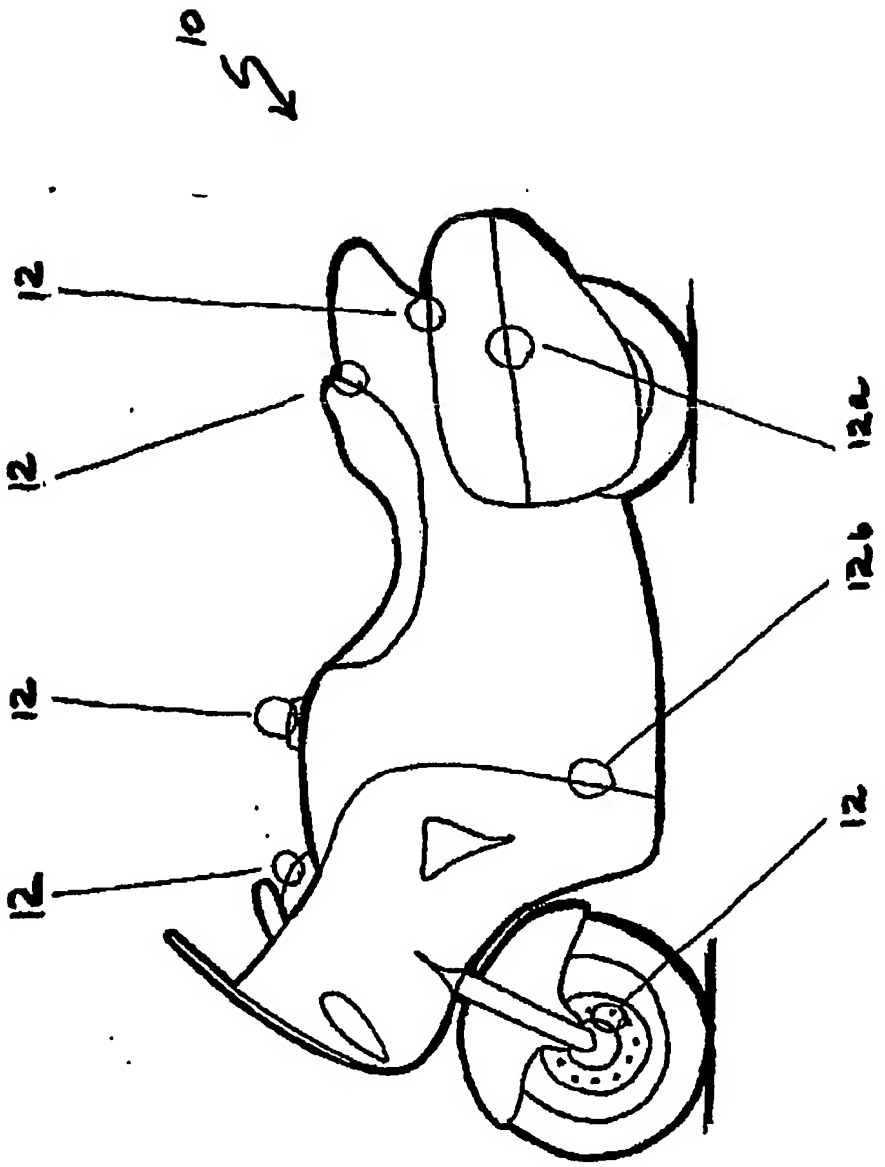


Figure 1

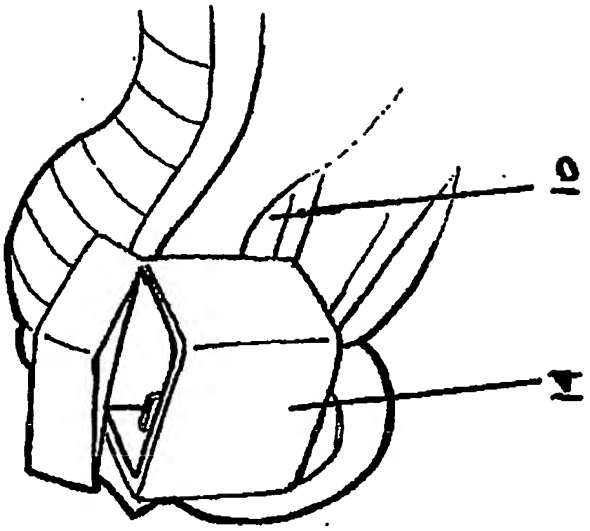


Figure 3

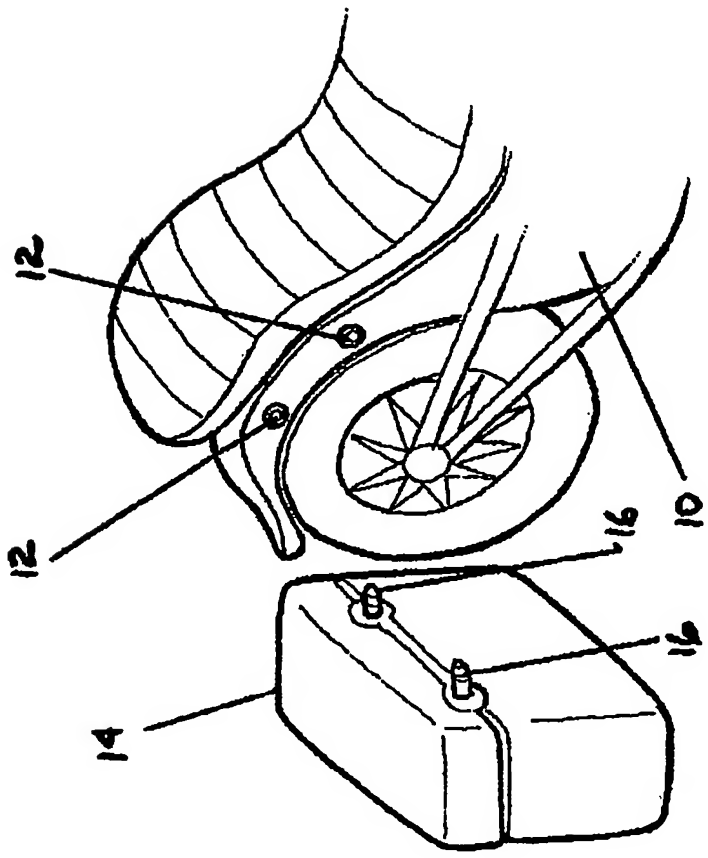


Figure 2

Figure 4

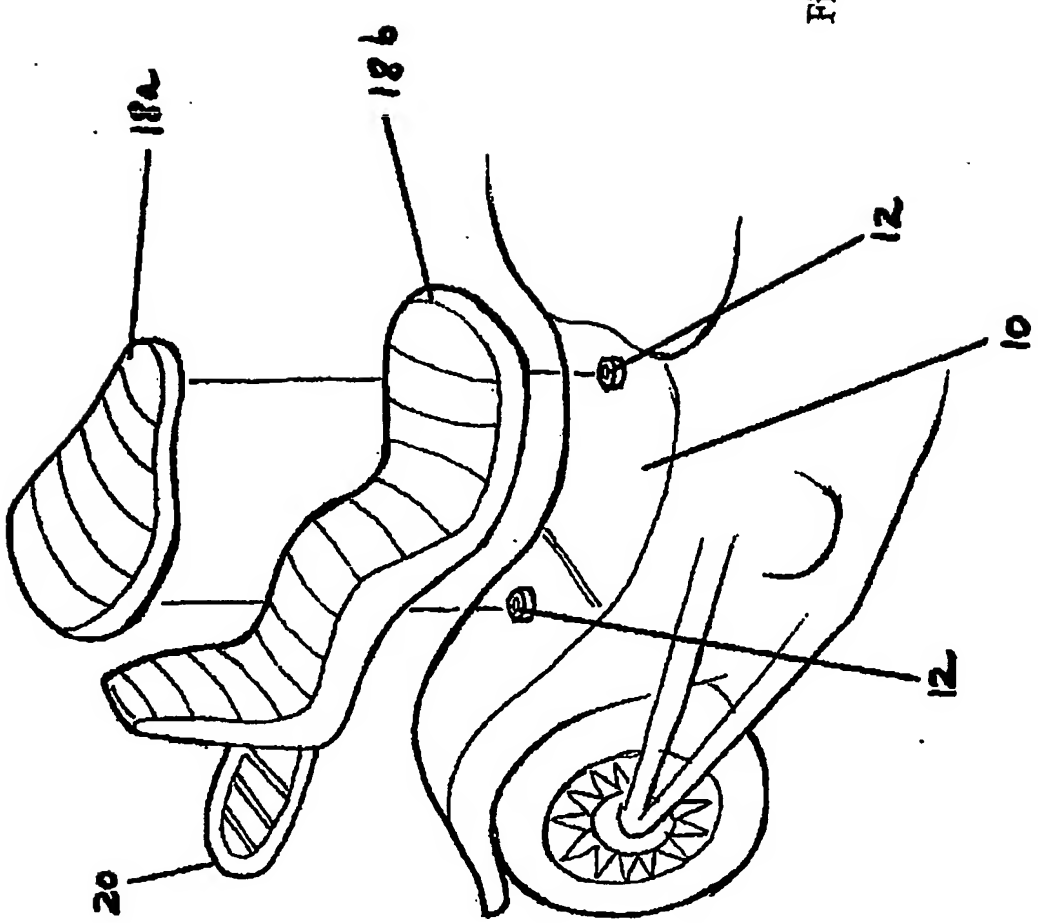
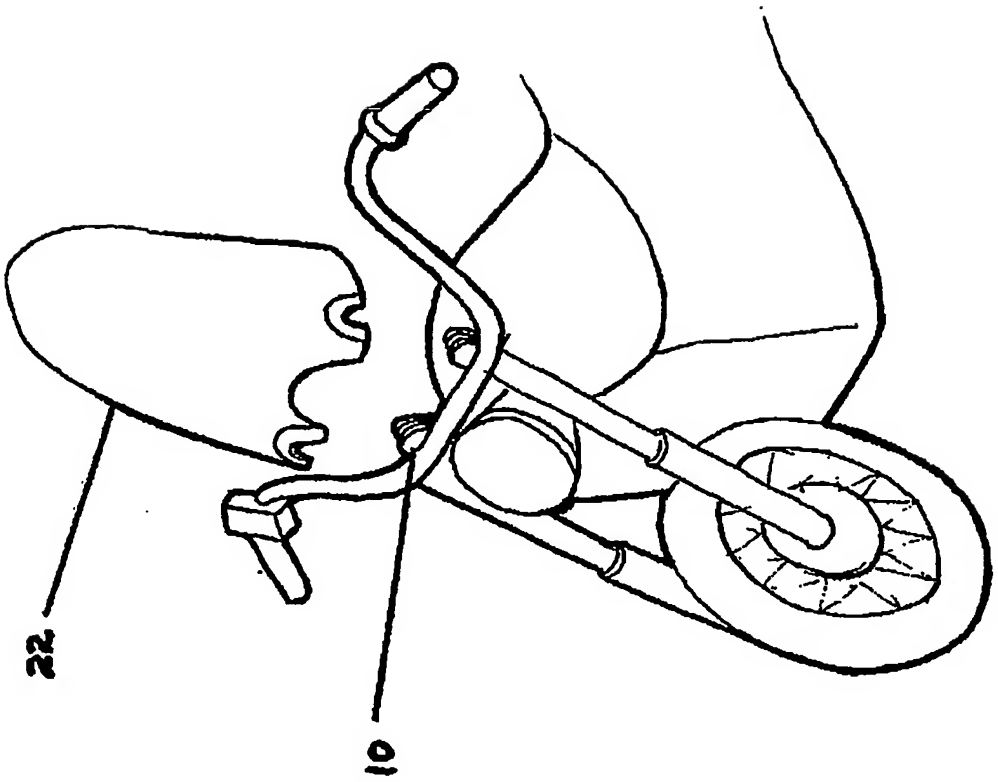


Figure 5



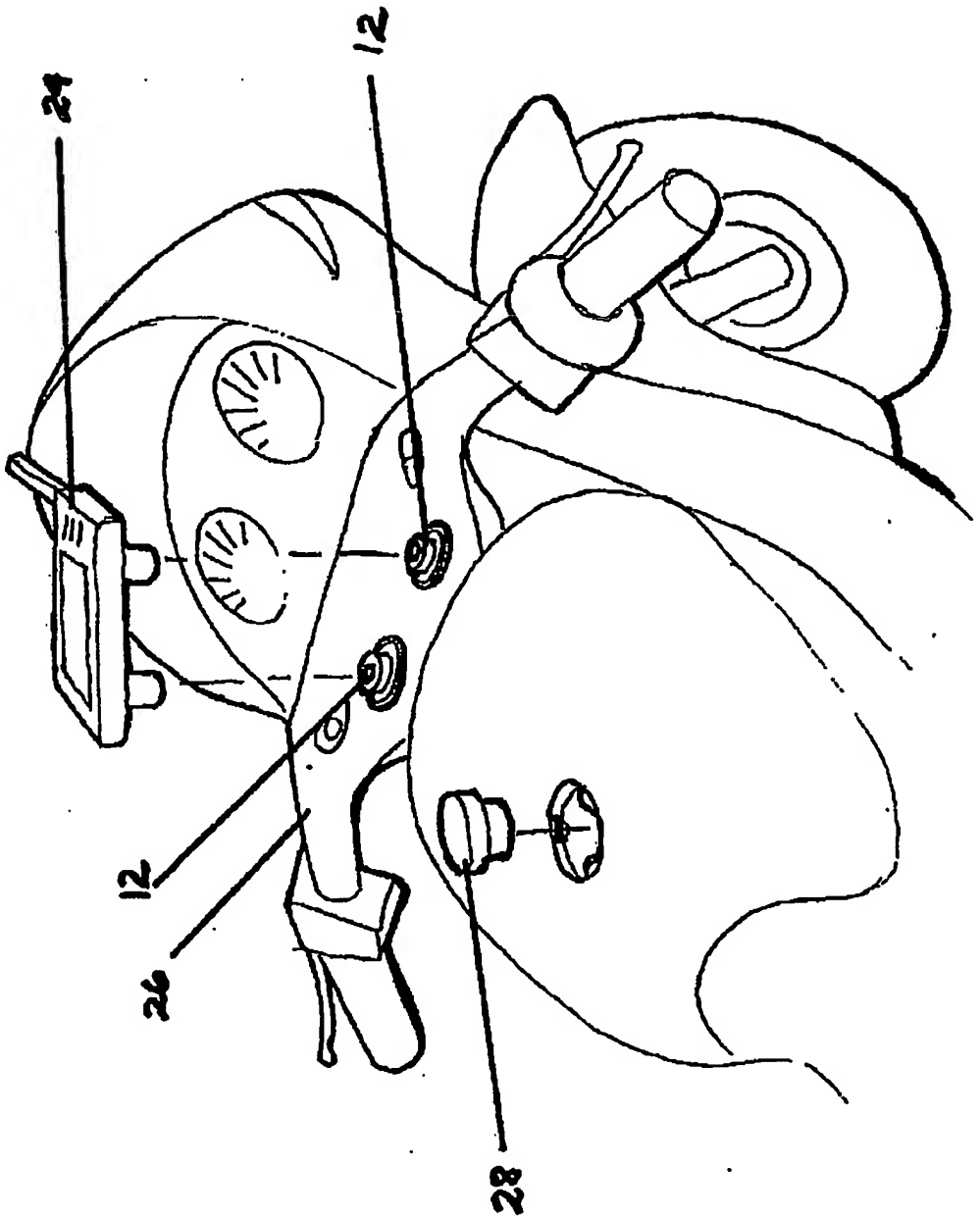


Figure 6

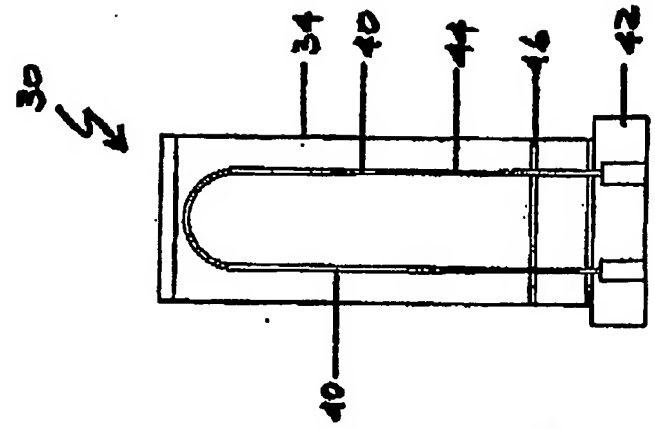


Figure 9

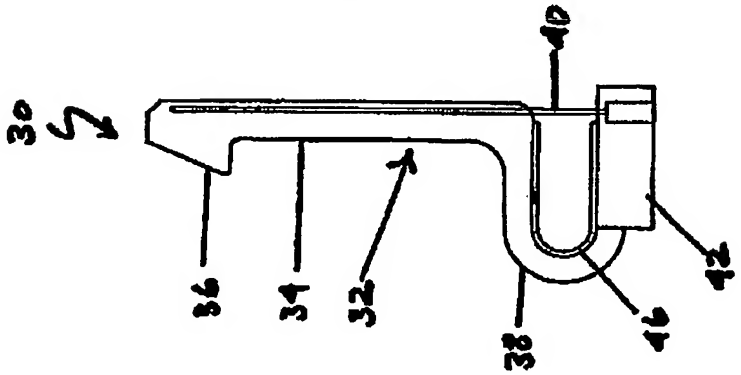


Figure 7

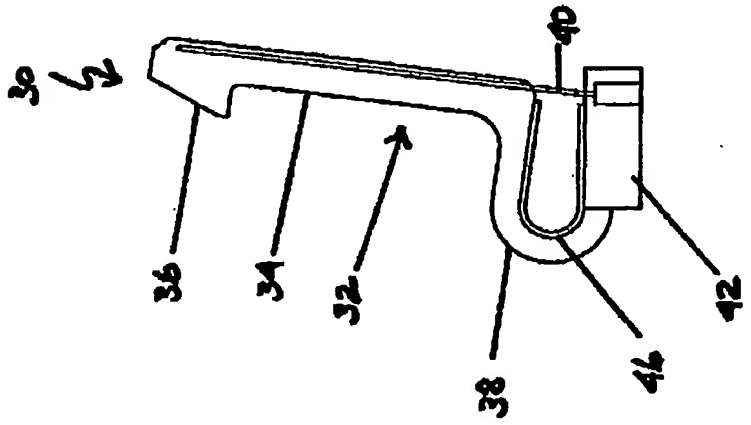


Figure 8

Figure 10

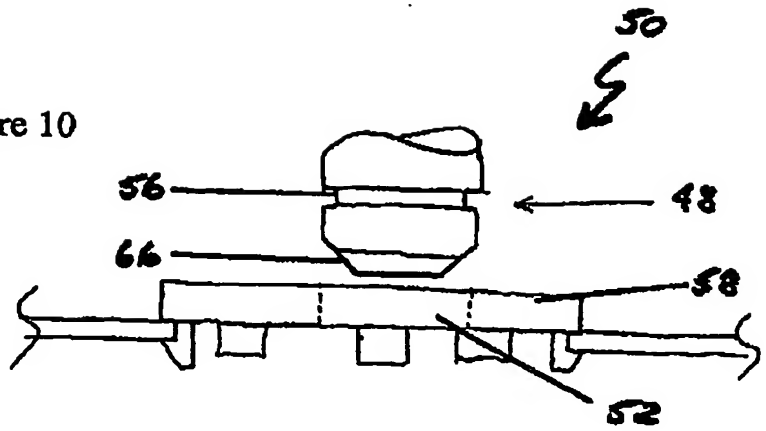
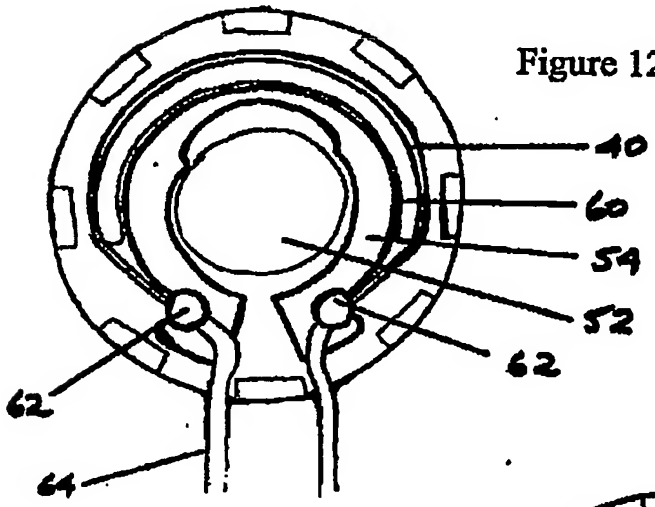


Figure 12



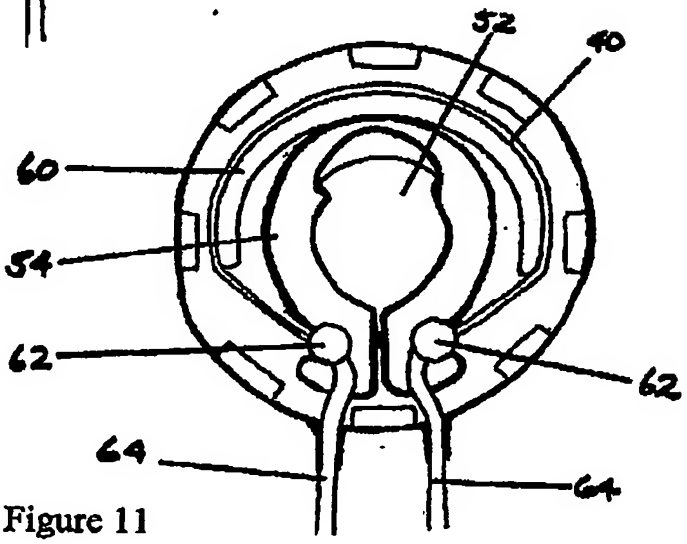


Figure 11

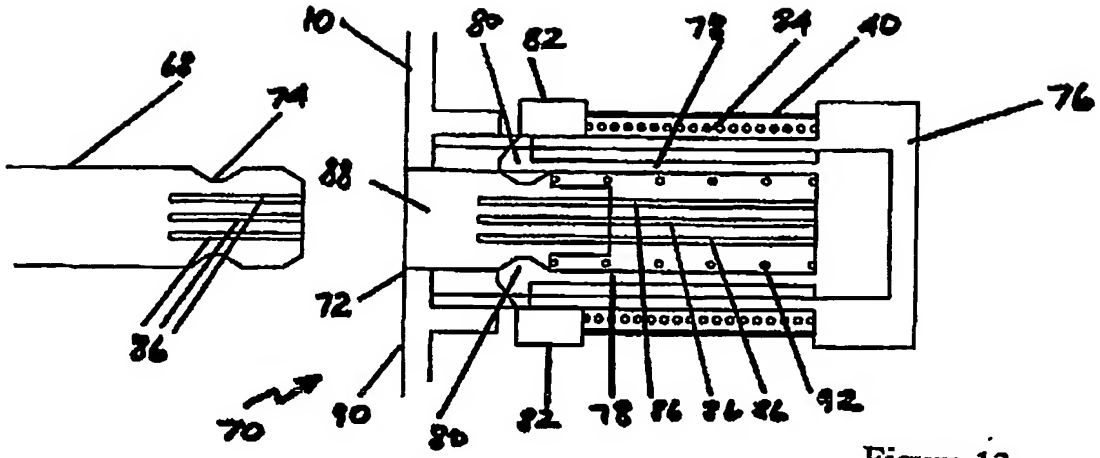


Figure 13

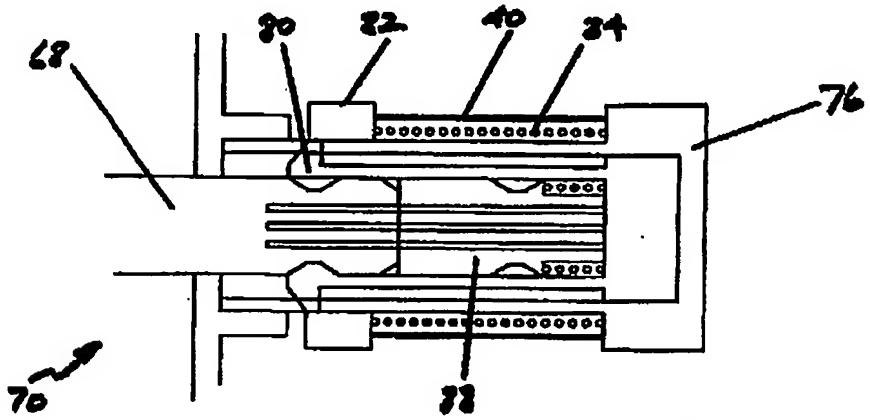


Figure 14

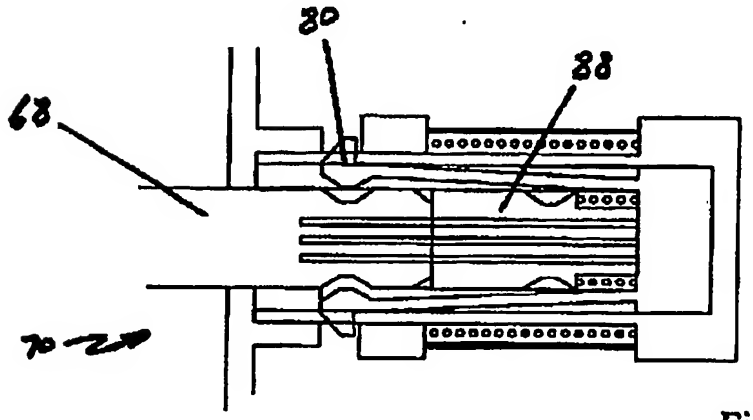


Figure 15

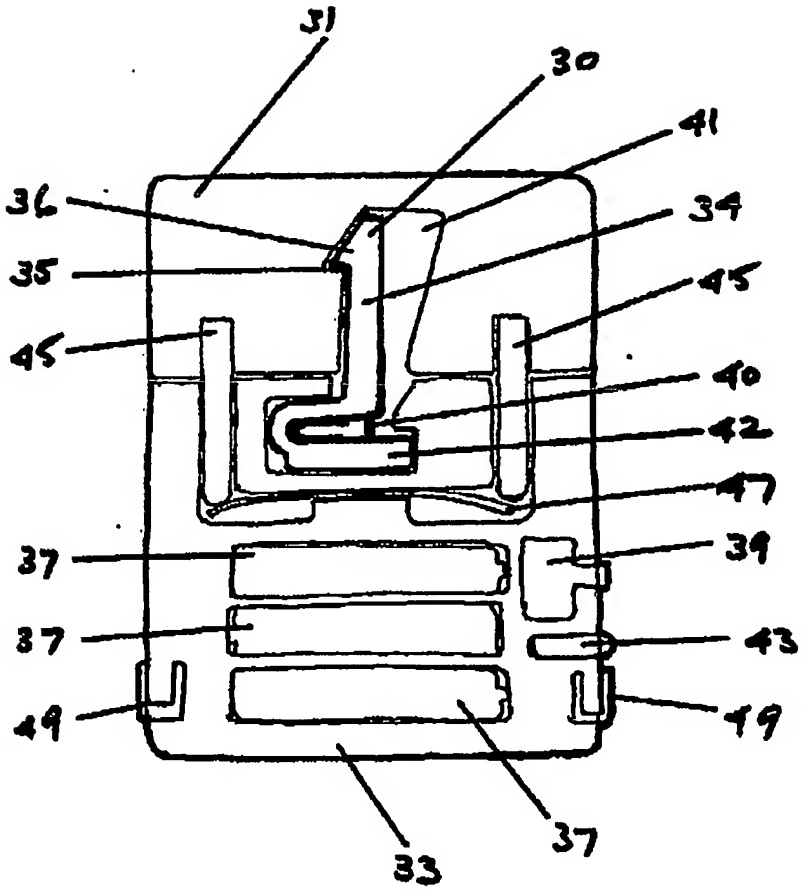


Figure 16

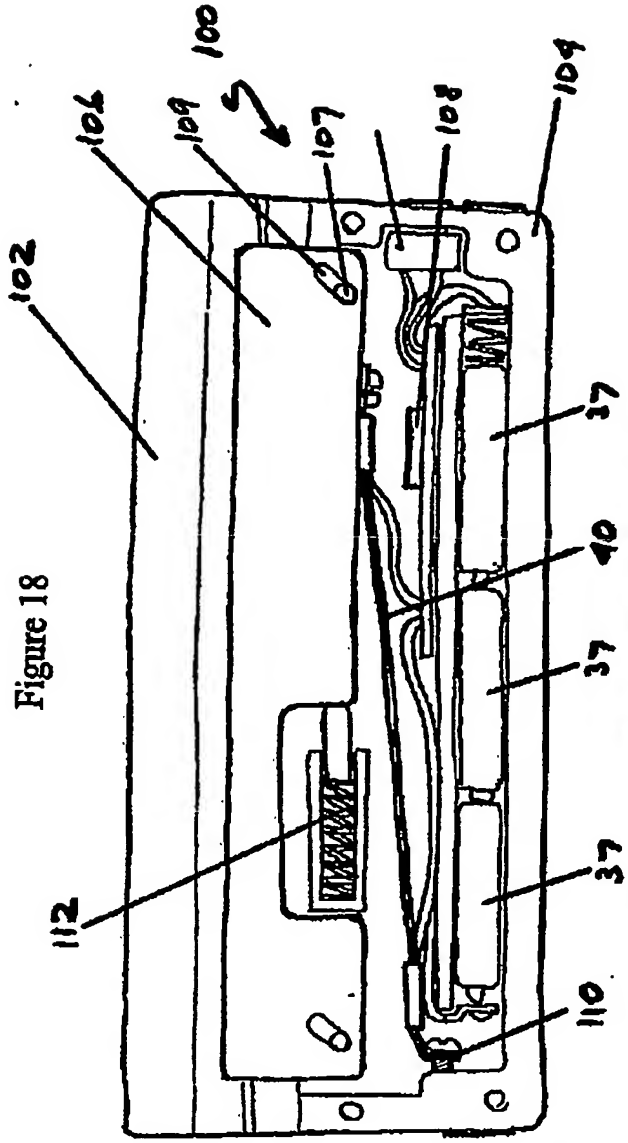


Figure 18

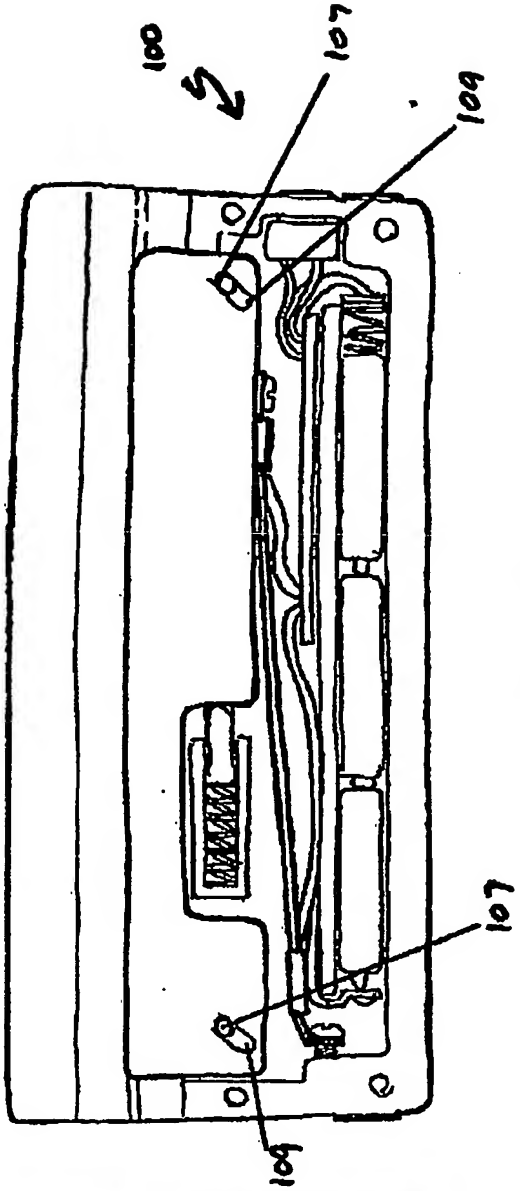


Figure 20

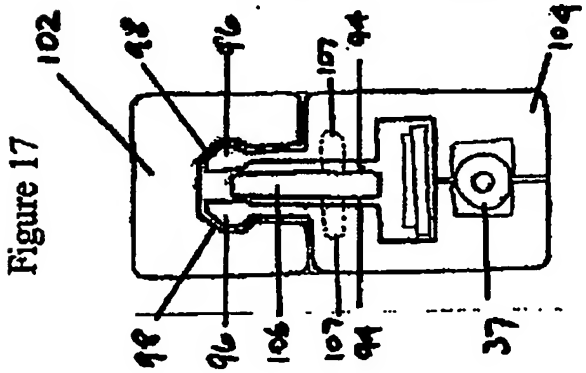


Figure 17

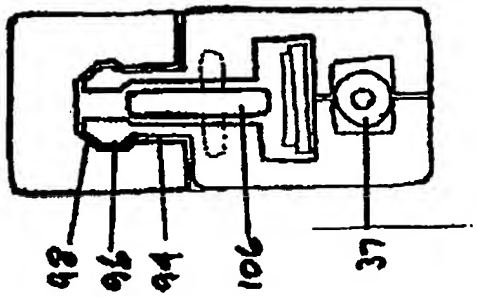


Figure 19

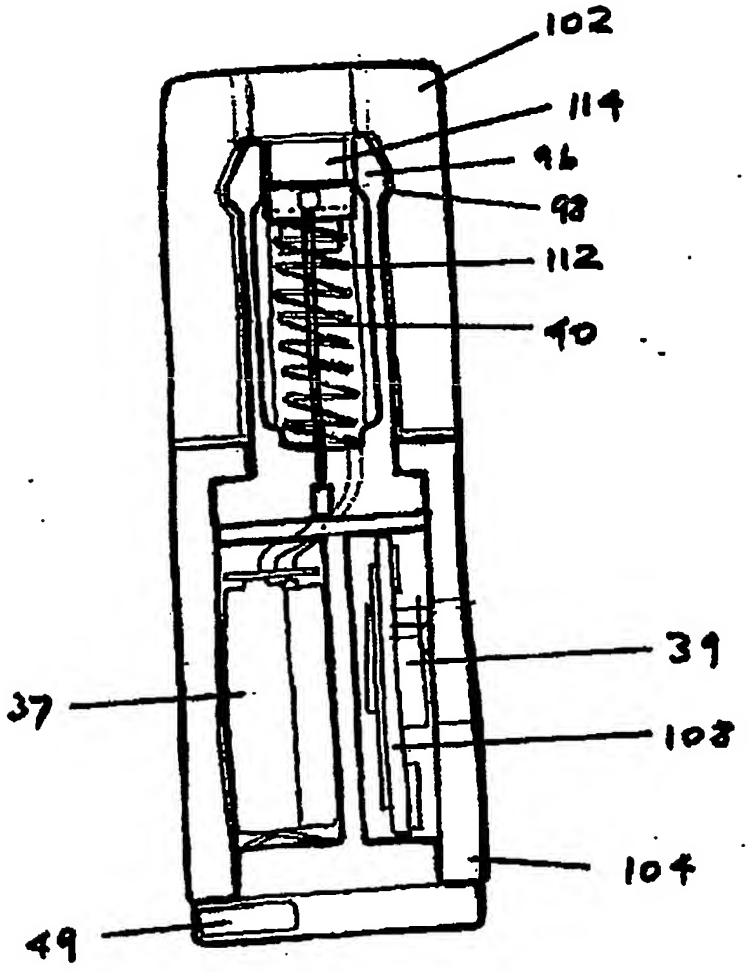


Figure 21

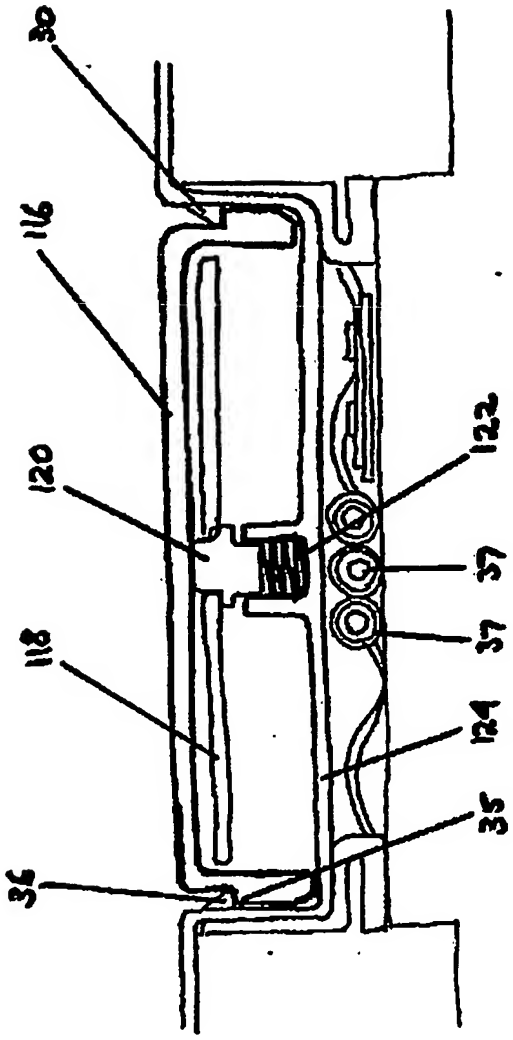


Figure 22

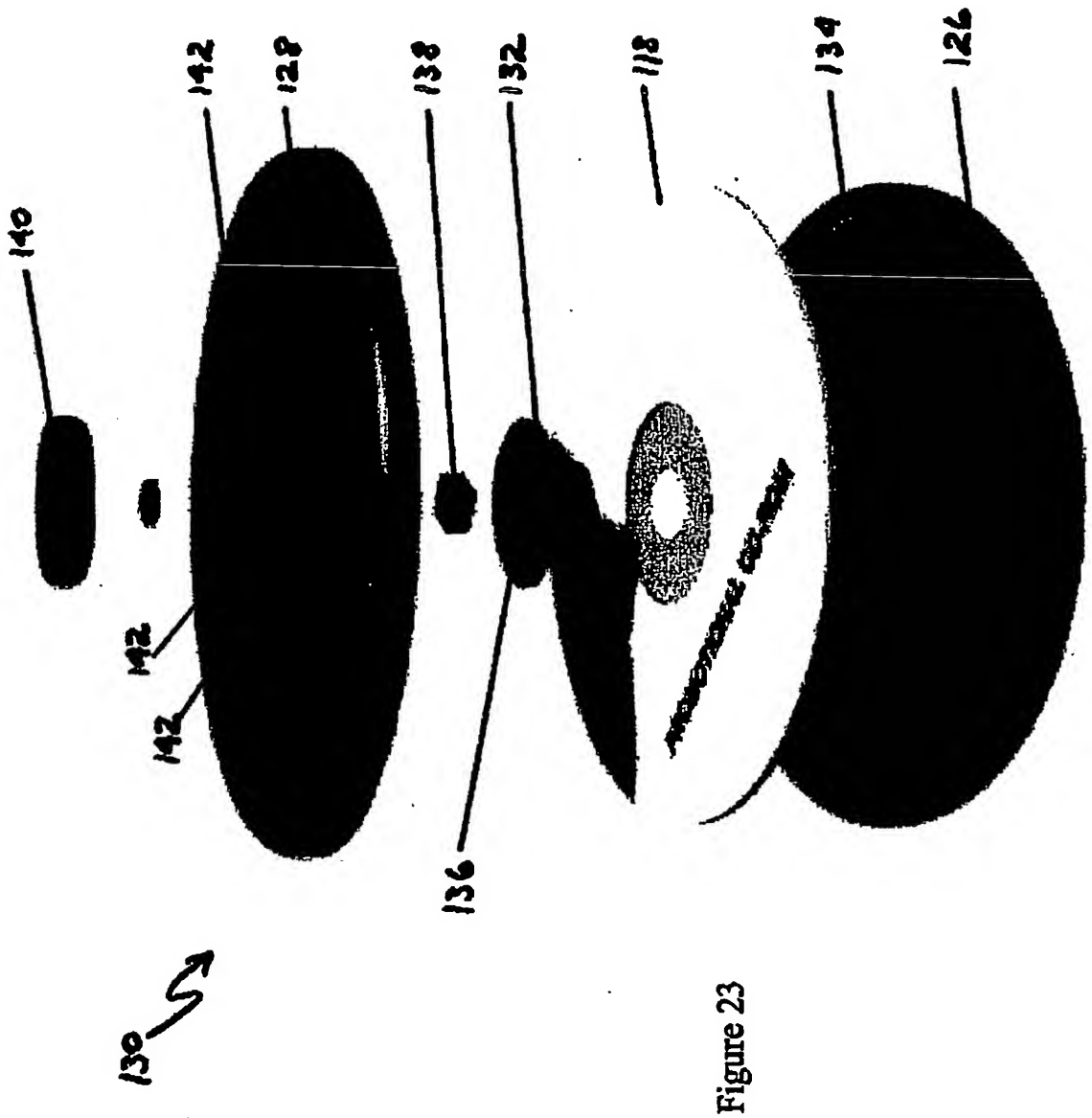


Figure 23

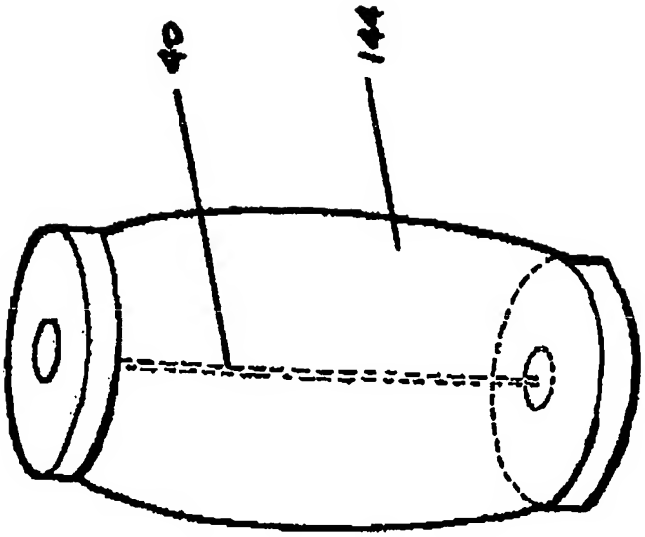


Figure 25

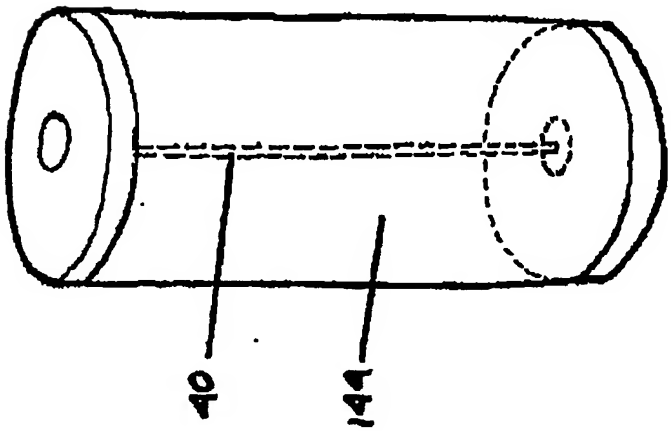


Figure 24

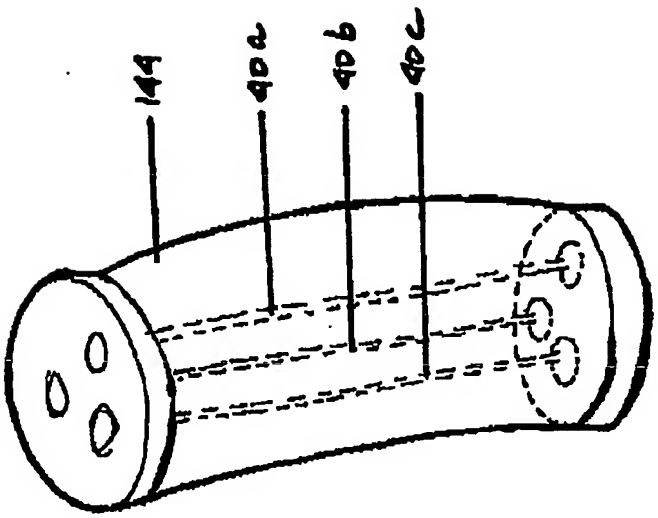


Figure 27

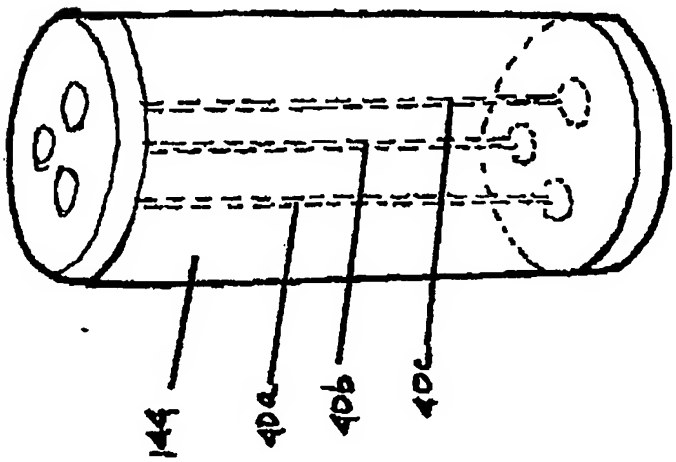


Figure 26

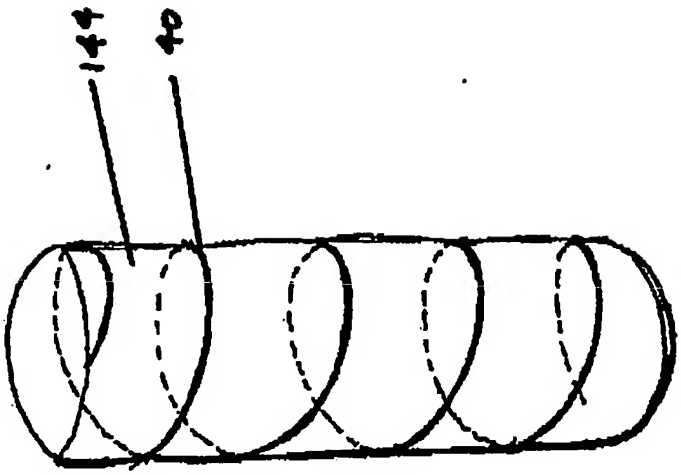


Figure 29

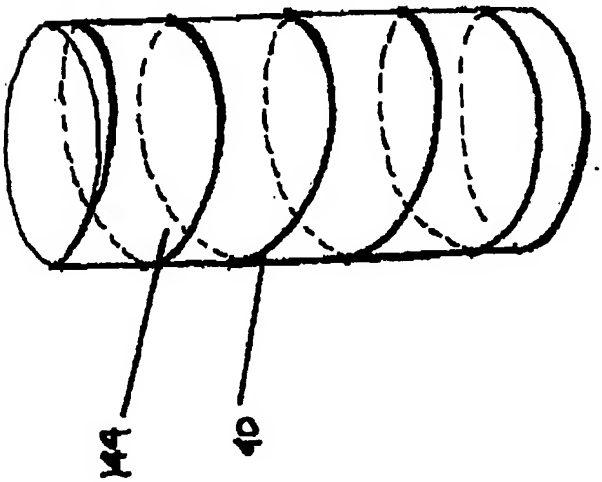


Figure 28

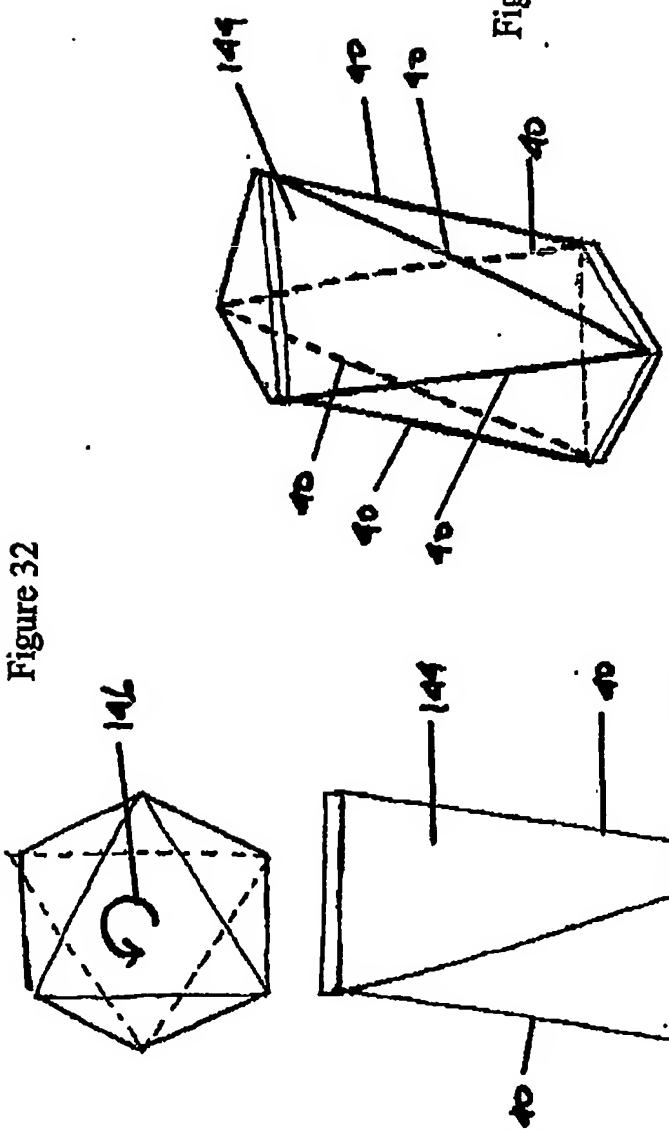


Figure 31

Figure 32

Figure 30

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/AU04/001580

International filing date: 17 November 2004 (17.11.2004)

Document type: Certified copy of priority document

Document details: Country/Office: AU
Number: 2003906324
Filing date: 17 November 2003 (17.11.2003)

Date of receipt at the International Bureau: 08 December 2004 (08.12.2004)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse